IN THE U.S. PATENT AND TRADEMARK OFFICE

In re Application of Teruyuki KAWATANI et al.

Serial No.: 10/606,736 Art Unit: 3676

Filed: June 27, 2003 Examiner: Suzanne Dino Barrett

For: FASTENING STRUCTURE INCLUDING A BOLT HAVING A SERRATION THAT IS PRESS - FIT INTO A BOLTHOLE OF A FLANGE

VERIFICATION OF ENGLISH TRANSLATION

Commissioner for Patents
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Sir:

I, Hiroshi YAMAZAKI, declare that I am conversant in both the Japanese and English languages and that the English translation as attached hereto is an accurate translation of Japanese Patent Application No. 10-094411 filed on April 7, 1998.

Signed this 10th day of May, 2004

Hiroshi YAMAZAKI

PATENT OFFICE

JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: April 7, 1998

Application Number: Patent Application. No. 10-094411

Applicant: Koyo Seiko Co. Ltd.

March 19, 1999

Commissioner,

Takeshi ISAYAMA

Patent Office (seal)

Reg. No. 11-3017123

Document Name:	Application for Patent
Docket No.:	159304
Date of Application:	April 7, 1998
Addressee:	Commissioner, Patent Office
International Patent Classification:	F60B 35/18
Title of the Invention:	FASTENING STRUCTURE
Number of Claim(s):	2

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Item: Specification 1 copy
Item: Drawing 1 copy
Item: Abstract 1 copy

Registration No. of General Power: 9704591

Document Name: Specification

Title of the Invention: Fastening Structure

What is claimed is:

1. A fastening structure wherein a bolt whose one portion in an axial direction of an outer peripheral surface is provided with a serration is press-fit into a bolthole formed in a flange portion of a mounting member,

a first distance between one axial end portion of the serration and one end surface of the flange portion exceeds 13 % of a thickness in the axial direction of the flange portion, and

a second distance between the other axial end portion of the serration and the other end surface of the flange portion exceeds 13 % of the thickness in the axial direction of the flange portion.

2. A fastening structure as claimed in claim 1, wherein

a center portion in the axial direction of the serration substantially coincides with a center portion in the axial direction of thickness of the flange portion.

Detailed explanation of the invention:

[0001]

The technical field to which the invention belongs:

The present invention relates to a fastening structure for fastening a bolt to a flange by press-fitting a serration of the bolt into a bolthole of the flange.

[0002]

Prior art:

There has conventionally been a mechanism as shown in Fig. 4, which adopts this kind of fastening structure. This structure is a structure for fastening a brake disk 103 and a wheel member 110 to a flange 102 of an inner ring member 105 by means of a bolt 101.

[0003]

According to this fastening structure, the bolt 101 is fixed to the flange 102 by press-fitting a serration 106 formed on the bolt 101 into a bolthole 107 of the flange 102. Then, the brake disk 103 and the wheel member 110 are fitted around this bolt 101 and fastened by means of the nut 111.

[0004]

Subjects that the invention is to solve:

However, in the aforementioned conventional fastening structure, as shown in Fig. 3, an inner peripheral surface 107A of the bolthole 107 of the flange 102 is pressed by the serration 106 when the bolt 101 is press-fit

into the flange 102, so that the flange 102 is elastically deformed. Due to this elastic deformation, a flange surface 102A on the bolt head side is deformed into a convex shape, while a flange surface 102B on the opposite side is deformed into a concave shape.

[0005]

As described above, if the flange surfaces 102A and 102B are deteriorated in flatness, then the brake disk 103 cannot be mounted parallel to the flange surface 102B. This leads to the problem that one-sided abutment of the brake disk 103 is caused, generating vibrations and abnormal noises.

[0006]

Accordingly, the object of the present invention is to provide a fastening structure capable of preventing the deterioration in flatness of the flange surface when the serration of the bolt is press-fit into the flange.

[0007]

Means for solving the subjects:

In order to achieve the aforementioned object, the invention of claim 1 provides a fastening structure wherein a bolt whose one portion in an axial direction of an outer peripheral surface is provided with a serration is press-fit into a bolthole formed in a flange portion of a mounting member,

a first distance between one axial end portion of the serration and one end surface of the flange portion exceeds 13 % of a thickness in the axial direction of the flange portion, and

a second distance between the other axial end portion of the serration and the other end surface of the flange portion exceeds 13 % of the thickness in the axial direction of the flange portion.

[0008]

According to the fastening structure of the present invention, the serration is located apart from the respective end surfaces of the flange portion by the first and second distances, and the first and second distances each exceed 13 % of the thickness of the flange portion. With this arrangement, when the bolt is press-fit into the flange portion, the serration presses the bolthole inner peripheral surface only in a region far from both the end surfaces of the flange portion (in a region deeper than 13 % of the thickness). In the regions close to the respective end surfaces of the flange portion (in each region shallower than 13 % of the thickness), the serration does not press the bolthole inner peripheral surface.

[0009]

By thus limiting the region where the serration of the bolt presses the bolthole inner peripheral surface to

the region located far apart from both the end surfaces of the flange portion, the flange surface can be prevented from deteriorating in flatness when the serration is press-fit into the flange.

[0010]

The fastening structure of the invention of claim 2 is in accordance with the fastening structure of claim 1, and a center portion in the axial direction of the serration substantially coincides with a center portion in the axial direction of thickness of the flange portion.

[0011]

According to the invention of claim 2, the center portion in the axial direction of the serration is made to substantially coincide with the center portion in the direction of thickness of the flange portion. With this arrangement, the dimension in the axial direction of the serration can be maximized with the flatness of the flange surface maintained, thereby allowing its slip torque to be maximized.

[0012]

Embodiments of the invention:

Hereinbelow, embodiments of the present invention will be described in more detail.

[0013]

Fig. 1 shows an embodiment of the fastening structure of the present invention. In this embodiment, a bolt 5 is press-fit into a bolthole 3 formed in a flange portion 2 of a mounting member 1. A serration 7 is formed on a part in an axial direction of an outer peripheral surface 6 of the bolt 5.

[0014]

A first distance D between one axial end portion 7A of this serration 7 and an end surface 2A on a bolt head 8 side of the flange portion 2 occupies 18 % of the thickness A in the axial direction of the flange portion 2. A second distance C between the other axial end portion 7B of this serration 7 and the other end surface 2B of the flange portion 2 occupies 30 % of the above thickness A.

[0015]

Then, the center portion 10 in the axial direction of this serration 7 is made to substantially coincide with the center portion 11 in the direction of thickness of the flange portion 2.

[0016]

According to the fastening structure of the above construction, the serration 7 is located apart from both the end surfaces 2A and 2B of the flange portion 2 by the first and second distances D and C, and the first and second distances D and C each exceed 13 % of the thickness A of the

flange portion 2. With this arrangement, when the bolt 5 is press-fit into the flange portion 2, the serration 7 presses the bolthole inner peripheral surface 13 only in the far region located far from both the end surfaces 2A and 2B of the flange portion 2 (in the region F deeper than 13 % of the thickness A). In the regions close to both the end surfaces 2A and 2B of the flange portion 2 (in the regions G and H shallower than 13 % of the thickness), the serration 7 does not press the bolthole inner peripheral surface 13.

[0017]

As described above, by limiting the region where the serration 7 of the bolt 5 presses the bolthole inner peripheral surface 13 to the region located far apart from both the end surfaces 2A and 2B of the flange portion 2, the flange surfaces 2A and 2B can be prevented from deteriorating in flatness when the serration 7 is press-fit into the flange portion 2. Therefore, for example, a brake disk 21 or the like can be mounted on the flat flange surface 2B, so that the one-sided abutment of the brake disk 21 or the like can be prevented, so that the generation of vibrations and abnormal noises can be prevented.

[0018]

The above effects will be described on the basis of a concrete experimental example. According to this experimental example, a plurality of fastening structure

samples in each of which a ratio (%) of the second distance C with respect to the thickness A of the flange portion 2 was set to a specified value within a range of 0% to 30% were subjected to the measurement of flange flatness. The measurement result is shown in Fig. 2(B). As shown in Fig. 2(B), when (C/A)×100% becomes equal to or smaller than 13%, the flatness of the flange surface 2B abruptly deteriorates. In the region where (C/A)×100% ranges beyond 13% to 30%, the flatness of the flange surface 2B is satisfactory and kept at an approximately constant value. As described above, by positioning the axial end portion 7B of the serration 7 apart from the flange surface 2B by a dimension of 13% or more of the thickness A, the flatness of the flange surface 2B is made satisfactory, thereby allowing the brake disk 21 or the like to be mounted on this flat flange end surface 2B. Therefore, the one-sided abutment of the brake disk or the like can be prevented, and the generation of vibrations and abnormal noises can be prevented.

[0019]

Fig. 2(A) shows the measurement result of the flange flatness of a plurality of fastening structure samples in each of which a ratio (%) of a distance B between the center portion 10 of the serration 7 with respect to the thickness A and the flange portion 2 is set to a specified value within a range of 30% to 70%. As shown in Fig. 2(A),

the flange flatness was the best when (B/A)×100% was 50%, and the flange flatness exhibited an approximately constant satisfactory value within the range in which (B/A)×100% ranges from 43% to 57%. In the case where (B/A)×100% was smaller than 43% or greater than 57%, the flange flatness deteriorated abruptly, as a result.

[0020]

In this embodiment, the center portion 10 in the axial direction of the serration 7 was made to substantially coincide with the center portion 11 in the direction of thickness of the flange portion 2. Therefore, the first and second distances D and C between the respective end portions 7A and 7B of the serration 7 and the respective end surfaces 2A and 2B of the flange portion 2 can be made approximately equal to each other, and accordingly, the flange flatness can be made satisfactory. As compared with a case where the center portion 10 is displaced from the center portion 11, a serration having a great dimension in the axial direction can be arranged in the deep region F, so that the slip torque can be increased.

[0021]

Effect of the invention:

As is definitely understood, the fastening structure of the invention of claim 1 is in accordance with the fastening structure wherein a bolt whose one portion in

an axial direction of an outer peripheral surface is provided with a serration is press-fit into a bolthole formed in a flange portion of a mounting member, the serration is located apart from the respective end surfaces of the flange portion by the first and second distances, and the first and second distances each exceed 13 % of the thickness of the flange portion.

[0022]

Therefore, when the bolt is press-fit into the flange portion, the serration presses the bolthole inner peripheral surface only in the far region located far from both the end surfaces of the flange portion (in the region deeper than 13 % of the thickness). In the regions close to both the end surfaces of the flange portion (in the regions shallower than 13 % of the thickness), the serration does not press the bolthole inner peripheral surface.

[0023]

As described above, by limiting the region where the serration of the bolt presses the bolthole inner peripheral surface to the region located far apart from both the end surfaces of the flange portion, the flange surfaces can be prevented from deteriorating in flatness when the serration is press-fit into the flange portion.

[0024]

The fastening structure of the invention of claim 2 is in accordance with the fastening structure of claim 1, and the center portion in the axial direction of the serration is made to substantially coincide with the center portion in the direction of thickness of the flange portion. With this arrangement, the dimension in the axial direction of the serration can be maximized with the flatness of the flange surface maintained, thereby allowing its slip torque to be maximized.

Brief Description of the Drawings:

Fig. 1 is a sectional view showing an embodiment of a fastening structure of the present invention.

Fig. 2(A) is a graph of a characteristic showing a variation in flange flatness when the serration center position is changed in the above embodiment, and Fig. 2(B) is a graph of a characteristic showing a variation in flange flatness when the serration end position is changed in the above embodiment.

Fig. 3 is a sectional view showing a conventional fastening structure.

Fig. 4 is a sectional view of an automobile wheel bearing having the conventional fastening structure.

Description of Reference Numbers:

1 ··· a mounting member, 2 ··· a flange portion, 2A, 2B ··· end surfaces, 3 ··· a bolthole, 5 ··· a bolt, 6 ··· an outer peripheral surface, 7 ··· serration, 7A, 7B ··· axial end portions, 8 ··· a bolt head, 10 ··· a center portion of serration, 11 ··· a center portion of flange portion, 13 ··· a bolthole inner peripheral surface.

Document Name: Drawings

Fig. 1

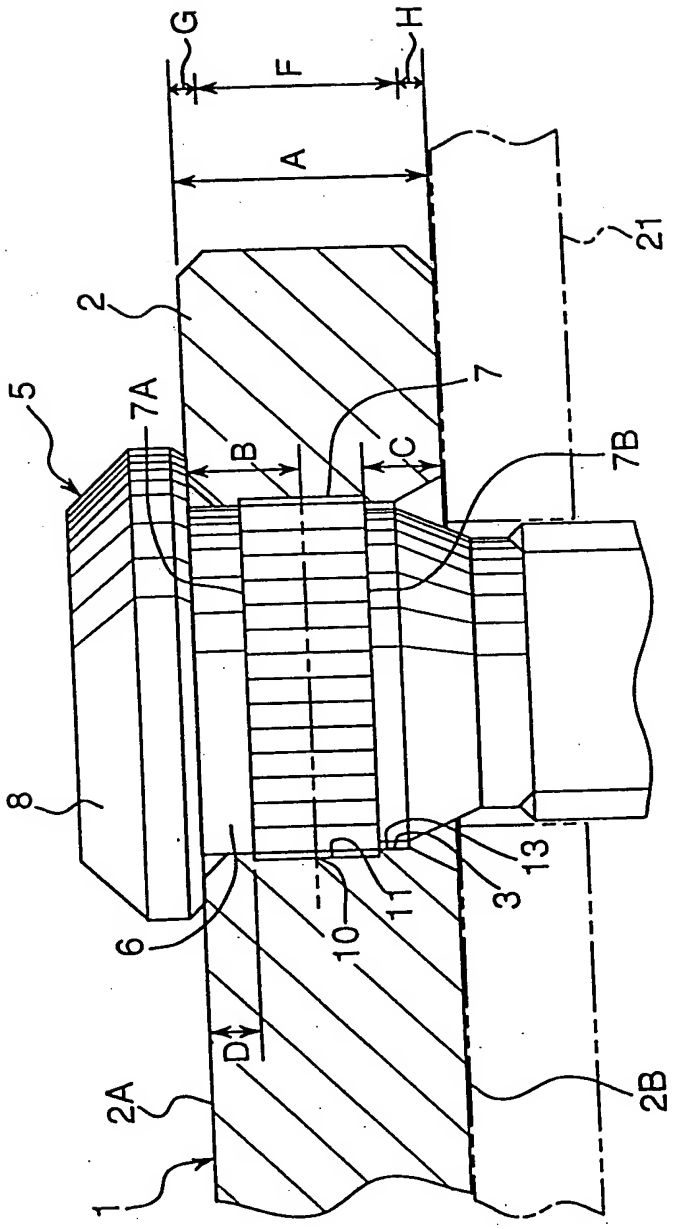


Fig. 2

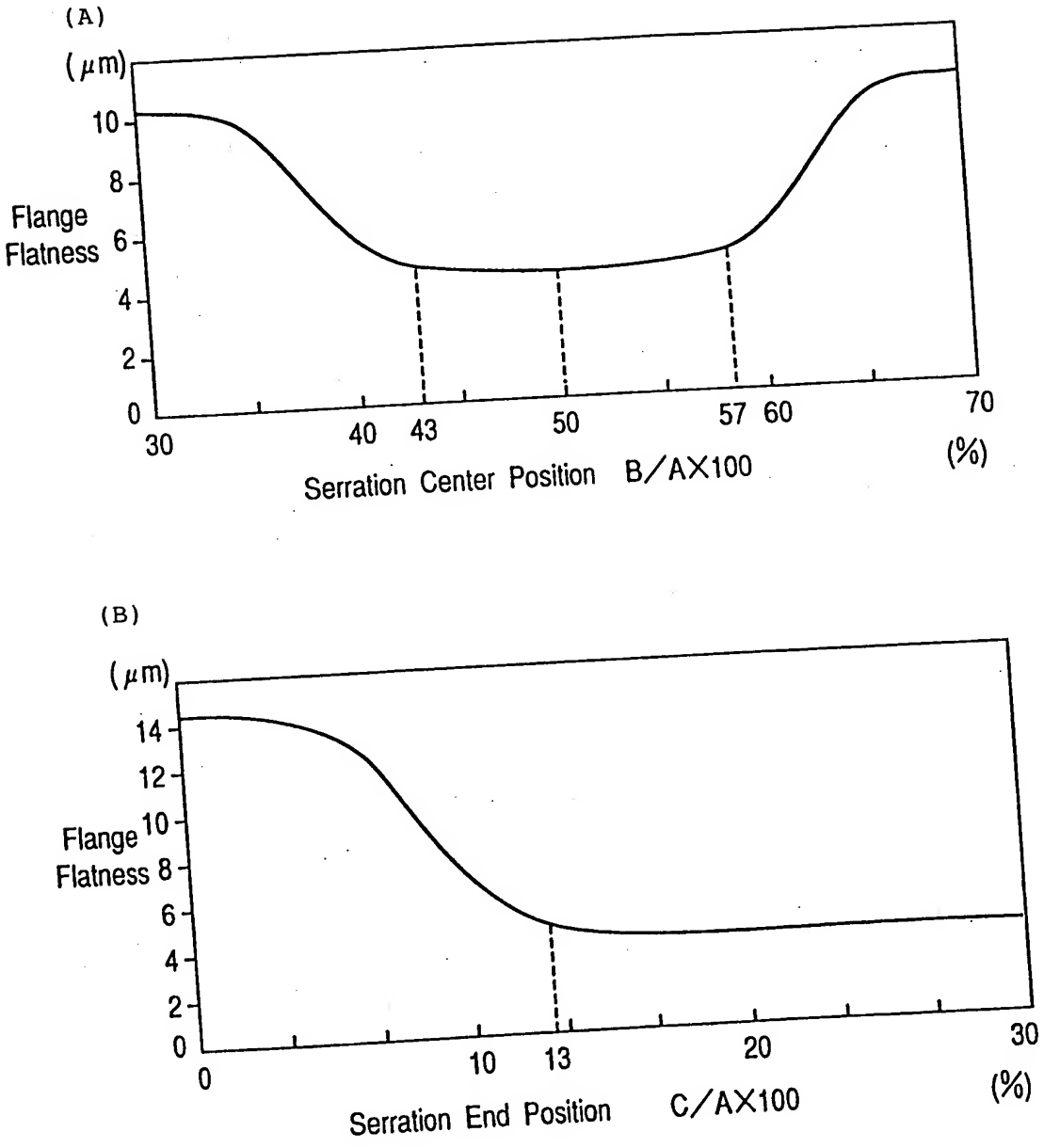

(A)
(μm)
10
8
Flange
Flatness
6
4
2
0
30
40
43
50
57
60
70
(%)
Serration Center Position B/AX100
(B)
(μm)
14
12
Flange
Flatness
10
8
6
4
2
0
0
10
13
20
30
(%)
Serration End Position C/AX100

Fig. 3

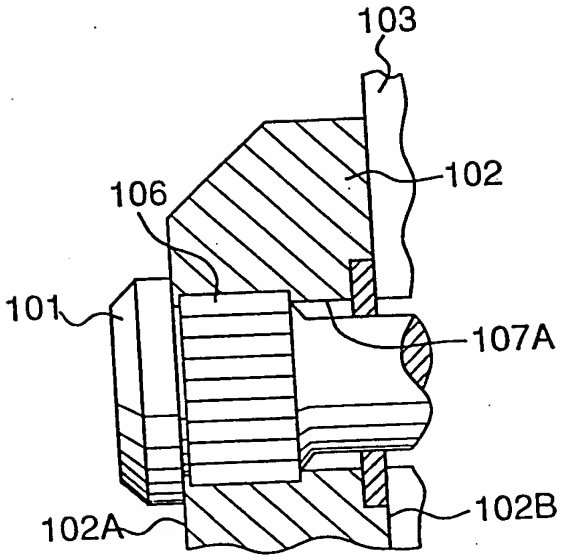
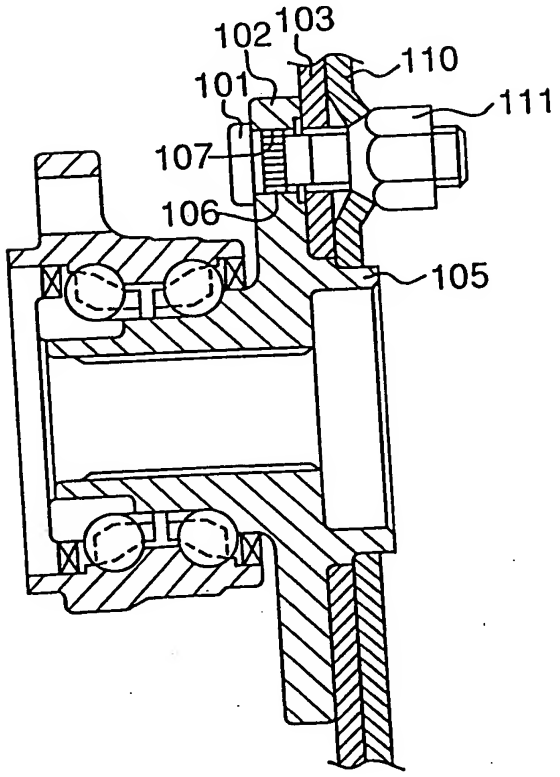


Fig. 4



Document Name: Abstract

Summary:

Object: To provide a fastening structure capable of preventing deterioration in flatness of a surface.

Solution:

In this fastening structure, a bolt 5, on a part in an axial direction of an outer peripheral surface 6 of which a serration 7 is formed, is press-fit into a bolthole 3 formed in a flange portion 2 of a mounting member 1. The serration 7 is located apart from respective end surfaces 2A and 2B of the flange portion 2 by first and second distances D and C, and the first and second distances D and C each exceed 13 % of the thickness A of the flange portion 2. With this arrangement, the serration 7 presses a bolthole inner peripheral surface 13 only in the region located far apart from both the end surfaces 2A and 2B of the flange portion 2.

Selected Figure: Fig. 1

Document Name: Official Correction Data

Corrected Document: Application for Patent

Approved or Supplemented Data:

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